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(54) Title: POSTNATAL STEM CELLS AND USES THEREOF

(57) Abstract: The invention generally relates to postnatal dental stem cells and methods for their use. More specifically, the invention relates in one aspect to postnatal dental pulp stem cells, use of the cells to generate dentin, and differentiation of the cells. In another aspect, the invention relates to human postnatal deciduous dental pulp multipotent stem cells, use of the cells to generate dentin, and differentiation of the cells.



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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/12276

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : A01N 63/00, 65/00; A61K 48/00; C12N 5/00, 5/02, 5/08

US CL : 435/325, 366; 424/93.1, 93.2, 93.21, 93.7

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 435/325, 366; 424/93.1, 93.2, 93.21, 93.7

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
Please See Continuation Sheet

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	GRONTHOS et al. Postnatal human dental pulp stem cells (DPSCs) in vitro and in vivo. Proc. Natl. Acad. Sci. USA. 05 December 2000, Vol. 97, No. 25, pages 13625-13620, entire document.	1-15 ----- 57
X — Y	GRONTHOS et al. Stem cell properties of human dental pulp stem cells. J. of Dental Research. August 2002, Vol. 81, No. 8, pages 531-535, entire document.	1-15 ----- 57
Y	KREBSBACH et al. Dental and skeletal stem cells: Potential cellular therapeutics for craniofacial regeneration. J. of Dental Education. June 2002, Vol. 66, No. 6, pages 766-773, entire document.	1-15 and 57
Y	NAKASHIMA et al. Induction of dental pulp stem cell differentiation into odontoblasts by electroporation-mediated gene delivery of growth/differentiation factor 11 (Gdf11). Gene Therapy. June 2002, Vol. 9, No. 12, pages 814-818, entire document.	57



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"B" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I"

later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X"

document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y"

document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"

document member of the same patent family

Date of the actual completion of the international search

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## INTERNATIONAL SEARCH REPORT

## C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SHI et al. Comparison of human dental pulp and bone marrow stromal cells by cDNA microarray analysis. Bone. December 2001, Vol. 29, No. 6, pages 532-539, entire document.	1-15
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Y		57
X	WO 02/07679 A2 (THE GOVERNMENT OF THE UNITED STATES OF AMERICA) 31 January 2002 (31.01.2002), entire document.	1-15
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Y		57

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/12276

## Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claim Nos.: 17  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:  
Claim 17 is directed to "the method of claim 4" but Claim 4 is directed to a stem cell, not a method.
3. ☐ Claim Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:  
Please See Continuation Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-15, 17 and 57

Remark on Protest

☐  
☐

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

## INTERNATIONAL SEARCH REPORT

PCT/US03/12276

### **BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING**

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be searched and examined, the appropriate additional search and examination fees must be paid.

Group I, claims 1-15, 17, and 57, drawn to a stem cell and a method of transplantation to generate bone.

Group II, claims 16 and 18-23, drawn to a method to produce human neural tissue.

Group III, claims 24-26, drawn to a method to produce human adipose tissue.

Group IV, claims 27-56, drawn to a method to generate dentin.

Group V, claim 58, drawn to a non-human mammal.

The inventions listed as Groups I-V do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The technical feature linking Groups I-V is the human dental pulp stem cell.

However, Gronthos et al. (2000) teaches the human dental pulp stem cell and methods for isolating it from human dental pulp tissue.

Furthermore, Gronthos et al. (2002) teaches the human dental pulp stem cell and methods for isolating it from human dental pulp tissue.

Furthermore, WO 02/07679 A2 teaches the human dental pulp stem cell and methods for isolating it from human dental pulp tissue.

Therefore, the technical feature linking the inventions of Groups I-V does not constitute a special technical feature as defined by PCT Rule 13.2, as it does not define a contribution over the prior art.

Absent a special technical feature, the groups of inventions are not so linked as to form a single general inventive concept under PCT Rule 13.1. Thus, unity of invention is lacking.

# INTERNATIONAL SEARCH REPORT

PCT/US03/12276

## Continuation of B. FIELDS SEARCHED Item 3:

WEST

Dialog (file: medicine)

search terms: dental(w)pulp, stem(w)cell?, human, CD146, CNPase, GFAP, nestin